PREDICTION OF SEASONAL PRECIPITATION IN CALIFORNIA

By JAMES M. JONES

[Weather Bureau, Eureka, Calif., November 15, 1930]

That the winters in California are relatively wet and the summers dry is too well known to require comment.

The winter rains and snows in the mountains store up the water so vitally necessary for irrigation and power purposes during the long dry summers. Hence it is obvious that any successful method of predicting seasonal or semiseasonal rainfall in this region would be of incalculable value, and many able meteorologists are at work on the problem.

But what is the nature of this seasonal precipitation in California? Does rain begin always at about the same date and continue until another fairly well established date? Is there a fixed date about the middle of the season on which we may say that half of the seasonal precipitation has now fallen and as much more may be expected? Let us investigate, taking the record at Eureka as our guide.

At all California stations the precipitation season is assumed to begin July 1 and to end June 30, so that January 1 is the mid-season date by the calendar.

But some seasons start wet and end dry, other seasons start dry and end wet, and some run close to the average throughout.

Table No. 1 shows, by seasons, the total precipitation at Eureka, one-half of the total, and the date on which the total since the preceding July 1 amounted to one-half of the total for the entire season. A study of this table reveals some interesting facts, viz:

TABLE 1

Season	Total precipitation for season	One-half total	Date on which one-half of total had been received	Season	Total precipitation for season	One-half total	Date on which one-half of total had been received
1887–88	34.47	17.23	Jan. 30	1909–10	40.36	20.18	Dec. 9
1888–89	34.14	17.07	Feb. 25	1910–11	32.09	16.04	Jan. 19
1889–90	74.10	37.05	Jan. 23	1911–12	38.70	19.35	Feb. 7
1890–91	35.41	17.70	Feb. 23	1912–13	36.03	18.01	Jan. 9
1891–92	38.14	19.07	Jan. 8	1913–14	37.32	18.66	Jan. 16
1892–93	49.17	24.58	Feb. 4	1914–15	42.42	21.21	Jan. 11
1893–94	55.20	27.60	Jan. 13	1915–16	39.99	20.00	Jan. 15
1894–95	45.97	22.98	Jan. 12	1916–17	31.36	15.68	Jan. 29
1895–96	52.45	26.22	Feb. 28	1917–18	24.34	12.17	Feb. 5
1896–97	51.10	25.55	Feb. 1	1918–19	39.80	19.90	Fec. 5
1897–98	35.12	17.56	Jan. 19	1919–20	23.95	11.98	Feb. 21
1898–99	35.72	17.86	Feb. 1	1920–21	48.81	24.40	Dec. 30
1899–1900	51.73	25.86	Dec. 30	1921–22	34.76	17.38	Feb. 9
1900–1901	47.58	23.79	Jan. 2	1922–23	25.18	12.59	Dec. 27
1901–02	51.96	25.98	Feb. 10	1923–24	20.72	10.36	Dec. 18
1902–03	51.73	25.86	Jan. 21	1924–25	41.50	20.75	Jan. 13
1903–04	65.21	32.60	Feb. 16	1925–26	26.78	13.39	Jan. 2
1904–05	32.74	16.37	Dec. 30	1926–27	50.58	25.29	Jan. 2
1905–06	38.50	17.90	Feb. 14	1927–28	30.71	15.36	Feb. 3
1906–07	50.54	25.27	Feb. 2	1928–29	29.40	14.70	Dec. 27
1907–08	35.99	18.00	Jan. 13	1929–30	23.53	11.77	Jan. 17
1908–09	42.96	21.48	Jan. 17				

Average date to which one-half of seasonal total has fallen, Jan. 21.
Earliest date with one-half of total seasonal recorded, Dec. 9, 1909.
Latest date with half of total recorded, Feb. 28, 1896.
Number of times earlier than Dec. 28, 4.
Number of times later than Feb. 14, 4.

1. The average date on which the halfway point in seasonal precipitation is reached is January 21.

2. One-half of the seasonal total has been recorded as early as December 9 (in 1909).

3. One-half of the seasonal total has occurred after February 28 (1896).

4. The season of 1895–96 was a wet one with a total precipitation of 52.45 inches, one-half of which fell after February 28.

The season of 1899–1900 was also a wet one with a total precipitation of 51.73 inches, but in this case one-half of the total amount was recorded before December 30.

5. In the dry season of 1919–20 (total 23.96 inches) one-half of the total amount fell after February 21. In the dry season of 1923–24 (total 20.72 inches) one-half of the total precipitation was recorded before December 18.

From the foregoing the conclusion is reached that more progress might be made if investigators would shorten the period for which they seek to make precipitation forecasts by means of ocean temperatures, etc. Accurate forecasts for even so short a period as two or three months would be of great value and it would seem that success in the making of such forecasts should be more easily attained than if the prediction attempts to cover an entire season, which, as we have seen, may be composed of a very wet part and a very dry part, such radically differing conditions certainly not resulting from the same cause and, therefore, not being predictable from the same data.

STORY TOLD BY THE TREE RINGS IS COMPLICATED BY THE DROUGHT [1]

The time-honored method of telling the ages of trees by the annual rings has been upset this year by the peculiarity of the season, says the Forest Service. Trees in most sections got off to a good start in the spring but were halted by the parching summer drought. Almost everywhere the growth of trees this year has been slight, but in some areas where late summer rains soaked the earth, a second period of growth followed the drought, and so altered the ring records. This has been the case in Alabama, according to reports from the State forester.

When a tree puts on a year's growth it adds a new ring of wood, and the diameter increases by double the thickness of the last tree rings. The age of a tree can therefore usually be told by counting the rings on the stump. As a consequence of the halting and the new advance in growth this season, Alabama trees in many cases put on a second thin layer, known to foresters as a "false ring." So the foresters of future years will have to be on their guard in computing ages in the living calendars of Alabama tree stumps. Such false rings are not uncommon over long periods of years.

This year's regular ring in most parts of the country shows much less thickness than the average year's ring, and even in those regions where growth was renewed late in the season the second ring has not resulted in a larger total year's growth. Most regions, however, did not get rain early enough to start the second ring.

REVISION OF WEATHER BUREAU PRECIPITATION NORMALS (MONTHLY WEATHER REVIEW SUPPLEMENT NO. 34)

The daily, monthly, and annual precipitation normals for the first-order stations of the United States Weather Bureau have been revised and the revised normals published in MONTHLY WEATHER REVIEW SUPPLEMENT No. 34, issued during the latter part of 1930.

The revision is based upon the 50-year period, January 1, 1878, to December 31, 1927. Ninety-six of the

[1] Reprinted from the Official Record, U. S. Department of Agriculture, Jan. 1, 1931.

present first-order stations had complete records for the entire period and the remaining 101 stations, many of which had records for 20, 30 and 40 years, were reduced to the basic period either by interpolating the monthly amounts for the missing years directly from charts of monthly totals of precipitation or by correcting the shorter periods to the full 50 years by the usual methods of comparison with the data from near-by stations. The total number of stations is 197.

The SUPPLEMENT also contains for each station the consecutive 14-day sums of the actual unsmoothed precipitation, from the beginning of January to the last fortnight of the year, which naturally contains 15 days.

An error is noted on page 30 (Erie, Pa.), viz, the annual total given as 39.36 inches should be 36.93 inches.—*A. J. H.*

RAINFALL OF 1930 IN ALASKA

Whereas extreme drought prevailed over large areas in continental United States during 1930, the Territory of Alaska seems to have had generous rains. Rainfall measurements in that Territory have not given, as yet, dependable averages except at individual stations. The rainfall on the average for Alaska during 1930, as computed from stations having a full year's record, may be placed at 34.42 inches; that amount is considerably more than the probable annual average for the Territory. A recent contribution to this REVIEW [2] places the mean annual precipitation of fully two-thirds of the Territory at less than 20 inches. It may be remembered that the precipitation of Alaska is heaviest along the southeast coast and lightest in the interior valleys; thus the mean for coastal Alaska at Juneau is 81.6 inches, and for Fairbanks, near the Yukon, but 11.7 inches. The departure from these means for 1930 was +15.8 inches for Juneau and +5.3 for Fairbanks.—*H. C. Hunter.*

THE INTERNATIONAL ICE PATROL SEASON OF 1930 [3]

The United States Coast Guard is gradually accumulating meteorological and oceanographic data for the region of the Grand Banks that must be of the greatest value to future students of navigation in that fog and ice infested region. The report for 1930 is already at hand and fully measures up to the standard set for previous years.

Icebergs in 1930 appeared off the Grand Banks of Newfoundland very much earlier than usual; accordingly, on February 11, the *Tampa* left Boston, Mass., in obedience to orders from United States Coast Guard headquarters, to make an ice-observation cruise. The *Tampa* reached the Tail of the Grand Banks 48 days earlier in the year than the first ice-patrol vessel did in 1929. The *Tampa* was relieved of the patrol duty by the *Mojave* on February 27, and the last-named in alternation with the *Modoc*, took on the patrol work for the remainder of the season.

[2] Fitton, Edith M.: The climates of Alaska, MONTHLY WEATHER REVIEW 58:85-103.
[3] U. S. Treasury—Coast Guard Bulletin No. 20, Washington, 1931, 50 pp., numerous charts and tables.

In May there were remarkably few bergs off the eastern edge of the Grand Banks. This failure of berg supply, as much as anything else, caused the extraordinarily ice-free conditions that were enjoyed south of the forty-sixth parallel throughout the remainder of the season. The season closed on June 10, unusually early.

Capt. Cecil M. Gabbett, commanding the Ice Patrol, commenting on the season remarks as follows:

> There was a marked deficiency of ice south of the Tail of the Grand Banks, as in 1927 and 1928. In 1930, only six different bergs drifted south of the forty-third parallel, the latitude of the Tail. This small number can be attributed partly to the unusually small amount of field ice reported this year from southeast of Newfoundland and partly to the narrowness of the southward-flowing cold stream off the eastern edge of the Grand Banks. Both of the above factors in turn doubtless depend upon the winds and the weather conditions that prevailed north of Newfoundland and Labrador during the preceding winter months. * * * After May 24 no bergs were sighted or reported, except north of the Grand Banks and along the Newfoundland coast in the vicinity of Cape Race and St. John's.
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> Throughout the season, the usual extension of cold water to the westward around the Tail of the Banks was largely absent.—A. J. H.

Temperature and visibility data are given in the subjoined table.

Temperature (F.) and visibility during International Ice Patrol, 1930

	Feb.	Mar.	Apr.	May	June [1]
Maximum	44	59	55	67	[1] 70
Minimum	25	22	29	36	37
Mean	33.3	39.6	39.6	47.1	51.6
Visability less than 2 miles, per cent of time	3	26.4	25.8	30.5	40.6

[1] For June 1-12 only.

SIMPLIFIED FORMULAS FOR RAINFALL INTENSITY [4]

By C. E. GRUNSKY

Subsequent to the publication of the simplified formulas for rain intensity in the MONTHLY WEATHER REVIEW of October, 1930, the writer's attention was called to the fact that the information obtained from the observer at Dam No. 4, Nuuanu Valley, Honolulu, was incorrect. The total rain in the 24 hours terminating at 5 p. m. on January 16, 1921, was only 12 inches and not 20 inches. Consequently the illustration is at fault and should be ignored.

However, on the same day 20.15 inches of rain fell at Maunawilli Ranch about 2 miles to the east on the windward side of the mountain.

Furthermore, on November 18, 1930, an automatic recorder belonging to the Geological Survey and situated in Moanalua Valley measured 15.2 inches of rain in three hours and 5.6 inches in one hour.

Based on this rain, the value of C in the appropriate formula should be taken at 5.6 and the probable maximum rain in any single minute was $5.6 = \sqrt[3]{0.0167} = 1.4$ inches.

[4] Supplement to article in the MONTHLY WEATHER REVIEW for October, 1930.